INSTRUCTION MANUAL

B+K PRECISION 1827

6-DIGIT AUTORANGING FREQUENCY COUNTER

B+K PRECISION

Product of DYNASCAN CORPORATION
6460 W. Cortland St., Chicago, Illinois 60635

INSTRUCTION MANUAL

FOR

MODEL 1827

6-DIGIT AUTORANGING FREQUENCY COUNTER

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INTRODUCTION

Your new frequency counter is a high-quality, lightweight, autoranging counter designed for frequency measurement in the range from 100 Hz to 30 MHz. A front panel function switch selects 1 SEC preset gate interval or AUTO range. In the AUTO position, the correct gate interval for maximum resolution without overranging the instrument is automatically determined and proper frequency unit indicators for kHz or MHZ are turned on. In the 1 SEC position, the display will indicate frequency to the closest Hz even if the leading most significant digit (MSD) is beyond the display range.

The display consists of six 7-segment, LED numerical display units and three LED's (light-emitting diodes) for units and overrange indication.

An internal time base of 4 MHz is generated by a crystal-controlled oscillator.

Rugged, compact design and exceptional accuracy combine to make this counter a valuable tool for the scientist, engineer, experimenter, hobbyist, and service technician. It not only is an excellent instrument for the laboratory, but also is rugged and compact for use in the field. It is low in power consumption and operates on 6 "AA" batteries, optional BC27 charger/adapter, or external DC.

SPECIFICATIONS

1. FREQUENCY CHARACTERISTICS

Range	100 Hz to 30 MHz (guaranteed) Function switch selects kHz or AUTO display reading.
Gate Time, Auto	10 mSEC or 100 mSEC (MHz reading), or 1 SEC (kHz reading), chosen automatically.
Accuracy	± Time base accuracy, ± 1 count.
Resolution	1 PPM of a 6-digit scale.
Display	Frequency of input signal with automatically positioned decimal point. Units of measurement (kHz, MHz) displayed on front panel by illuminated indicator.

2. INPUT CHARACTERISTICS

Impedance	10,000 ohms minimum.
Connector	RCA phono type.
Sine Wave Sensitivity	200 mV RMS; 100 Hz-200 kHz. 100 mV RMS; 200 kHz-30 MHz.
Maximum Input	200 V (peak AC + DC) to 500 Hz; derate linearly to 100 V (peak AC + DC) at 1 kHz; derate linearly to 25 V (peak AC + DC) at 30 MHz.

3. INTERNAL TIME BASE CHARACTERISTICS (REFERENCED TO 25° C)

Type	Crystal Oscillator.
Frequency	4.0 MHz.
Setability	± 0.25 PPM (± 1 Hz).
Temperature Stability	Better than ±0.001% (i.e. ±10 PPM) from 0-50°C ambient.
Maximum Aging Rate	10 PPM/Year, 1/PPM Month.

4. DISPLAY CHARACTERISTICS

Visual Display	6 digits with overflow, kHz and MHz indicators and anti-glare window.
Overflow Indication	Flashing light indicates display range is exceeded.
Display Refresh Interval	Fixed; 200 mSEC plus gate interval.

Battery Saver	The digits of the display are blanked in battery operation until the DISPLAY button is pushed. The display will remain on as long as the button is depressed and for an additional 10 seconds after released. External power defeats the battery saver and the displays will stay on continuously.

5. GENERAL

Power Requirements	Operates on 6-9V (6 "AA" Batteries); or 6.7 to 9.7 V at external power jack input.
Dimensions	6-5/8" D x 3¾" W x 1¾" H (17 x 9½ x 4½ cm).
Shipping Weight	Less than 1 lb. with batteries.
Accessory Cable CC - 51 (Supplied)	RCA phono-to-clip lead cable.

OPTIONAL ACCESSORIES (Not Supplied)

BC - 27	AC adapter and charger.
BP - 27	Battery Pack (6-AA NiCad rechargeable cells).
SA - 12	12 V automotive power cord.
CC - 52	DC power supply cord.
SA - 10	Signal tap with RCA plug-on tap cable.
MB - 27	Mounting bracket.
SA - 27	12" antenna.
LC - 18	Carrying case.
CC-51	RCA phono-to-clip lead cable (supplied.)
UP-27	Operating pack for 1827. Consists of one each of: BC-27, MB-27, SA-10, SA-12 and SA-27.

OPERATING PROCEDURE

A. CONTROLS AND FEATURES

1. **FUNCTION SWITCH.** Turns instrument on and selects preset (1 SEC) or AUTO counting range. In the AUTO range mode, proper gate interval is automatically selected by the instrument to fill all six digits, starting with the most significant digit, without overflow (also referred to as "overrange").

2. **INPUT JACK.** Phone type jack. 10 KΩ impedance.

3. **KHz FREQUENCY UNIT INDICATOR.** Indicates that the decimal point is placed to read measured frequency in kHz. This indicator is always on when the function switch is in the 1 SEC position, and the decimal point is as shown in Fig. 2.

4. **MHz FREQUENCY UNIT INDICATOR.** Indicates that decimal point is placed to read measured frequency in MHz.

5. **NUMERICAL DISPLAY.** Indicates frequency of the input signal.

6. **OVERRANGE INDICATOR.** Flashes when the frequency is beyond the selected display range.

7. **DISPLAY PUSHBUTTON.** Restores display blanked by automatic power saver feature. Allows display to remain on 10 seconds after button is released. Not used when external power is obtained from BC-27 adapter or other available external power options.

B. INTERPRETATION OF DISPLAY READINGS

For purposes of identification, the six display digits of the counter will be identified numerically as shown in the display of Fig. 2.

Digit #1 is to the extreme right and digit # 6 is to the extreme left. In addition, the most significant digits (MSD) and least significant digits (LSD) are indicated.

When the function switch is in the 1 SEC position, the decimal point is located as shown in Fig. 2 and the kHz lamp is lit. All readings are then indicated in kiloHertz. For example, if a frequency of 654,321 Hz is to be measured, the display would be as shown in Fig. 3. With the function switch still in the 1 SEC position, a measurement of 321 Hz would be displayed as shown in Fig. 4. Note that the unused digits register as zeros and the decimal point is retained in the kiloHertz position. The reading is displayed as 000.321 kHz, which is actually 321 Hz.

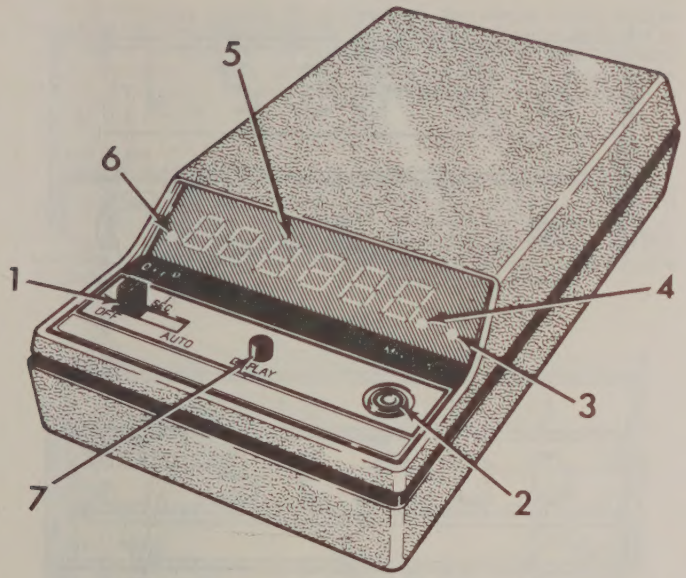


Fig. 1. Controls and features.

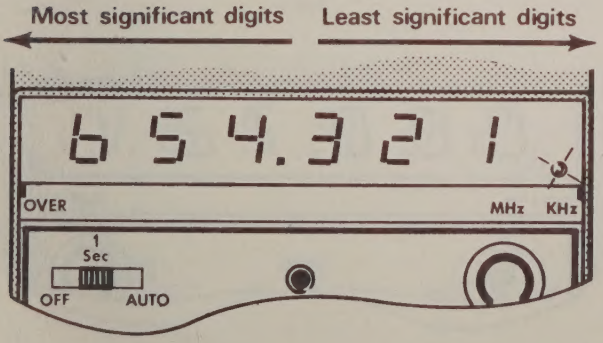


Fig. 2.

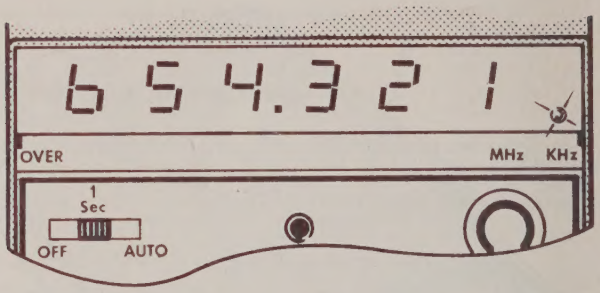


Fig. 3.

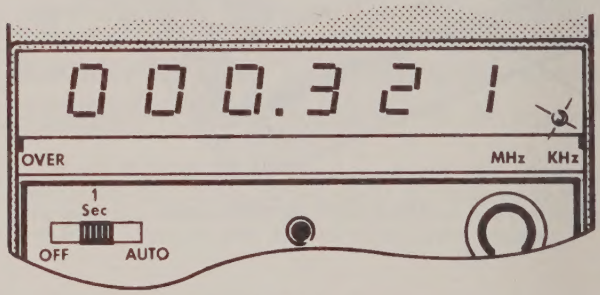


Fig. 4.

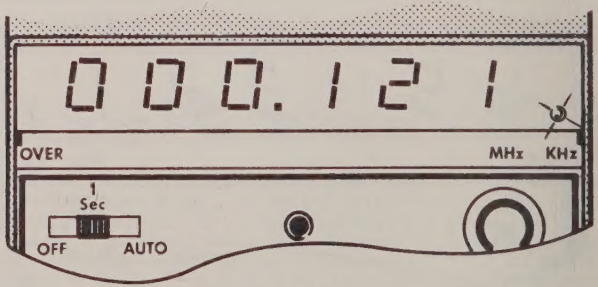


Fig. 5.

If a frequency of 121 Hz is measured, the display would read as shown in Fig. 5, which is 000.121 kHz. It should be noted here that as fewer digits are displayed, the accuracy of the reading decreases, because of the uncertainty of the last digit. With a tolerance of ±1 count on the reading displayed, a frequency of 121 Hz actually may be displayed as 120, 121 or 122 Hz.

With the function switch in the 1 SEC position, and with the reading greater than 1 MHz (for example, 1,654,321 Hz), only the last six digits of the frequency being measured will be indicated, as shown in Fig. 6. Note that the kHz lamp is lit and that the OVER lamp is flashing. This indicates that the most significant digit is not being displayed in the frequency count.

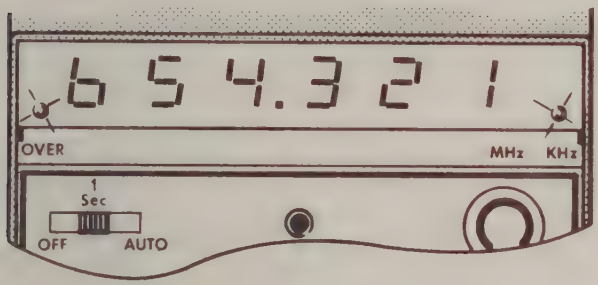


Fig. 6.

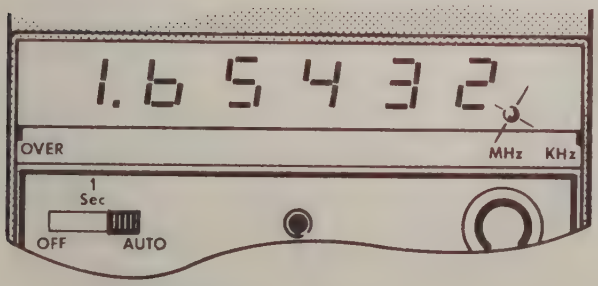


Fig. 7.

Maximum resolution to the Hz is obtained under these conditions because the least significant digit is displayed; however, the first and most significant digit cannot be determined.

When the condition described above occurs, the function switch should be placed in the AUTO position. The display corresponding to measurement of the frequency 1,654,321 Hz would then appear as shown in Fig. 7.

Note that the MHz lamp is now lit and that the least significant digit (1) is no longer being displayed at the right end of the display, and the most significant digit (1) has been added at the left end of the display. When the most significant digit is displayed, the OVER lamp is off.

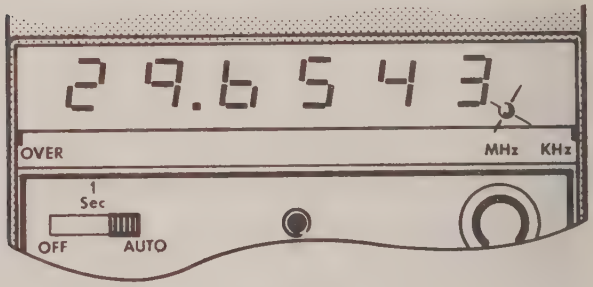


Fig. 8.

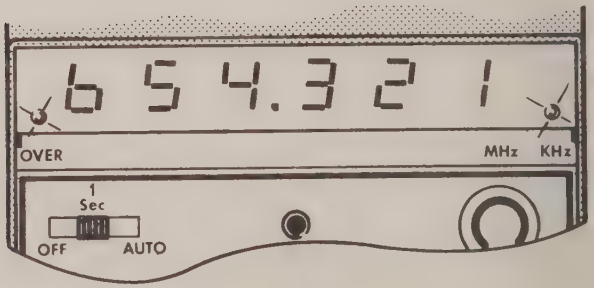


Fig. 9.

Now consider the case in which a measurement is to be performed at 29.654321 MHz. With the function switch in AUTO position, the frequency reading will be displayed as shown in Fig. 8. Notice that the two least significant digits (2 and 1) have been deleted. Also, the MHz lamp is lit, indicating the reading is displayed in MegaHertz. Because the most significant digits (2 and 9) are displayed, the OVER light is not lit. If it is desired to obtain maximum resolution of the frequency being measured (in other words, down to the Hertz), the function switch must be placed in the 1 SEC position. The reading will be displayed as shown in Fig. 9.

Notice that the least significant digits (2 and 1) are displayed and that the most significant digits (2 and 9) are *not* displayed. Because the most significant digits are not displayed, the OVER lamp will flash, indicating that the actual frequency being measured is *greater* than that displayed.

Remember that with the function switch in the AUTO position, the most significant digits are always displayed and the kHz or MHz light will be on as required to identify the units of measurement. For example, with the function switch in the AUTO position, and with a measurement of 321 Hz, the display of Fig. 4 is automatically obtained.

For maximum convenience of operation, the AUTO position of the function switch should be used. However, when it is desired to have the maximum resolution of the reading (to the Hertz) the 1 SEC position is selected.

Bear in mind that the least significant digits of the measured frequency displayed will *change as the reading is being observed,* the amount depending on the frequency stability of the frequency source being measured. An oscillator with the inductance and capacitance as frequency-determining elements may have a rather fast rate of change, while a crystal-controlled oscillator will provide a much more stable frequency reading.

C. AC-POWERED CHARGER/ADAPTER USE

Optional accessory Model BC-27 is recommended. The charger/adapter is designed for use with "AA" size Ni-Cad batteries (BP-27 Battery Pack available). It plugs into the power jack at rear of your frequency counter. Note that the slide switch on the charger/adapter must be in the proper position for either Ni-Cad or Carbon-Zinc/Alkaline battery operation.

D. BATTERY OPERATION WITH NON-RECHARGEABLE BATTERIES OR NI-CAD RECHARGEABLES

Your frequency counter will operate from 6 "AA" size batteries, rechargeable or non-rechargeables. Install as shown under BATTERY REPLACEMENT AND INSTALLATION.

b. A signal tap, such as the SA-10 (see "OPTIONAL ACCESSORIES"), is used in a 50-ohm coaxial cable to protect the transmitter output stage from load mismatch and to protect the counter input stage from excessive signal voltage. To determine the peak voltage of an RF carrier when the power and load are known, use the relationship:

$$E_{PEAK} = 1.4\sqrt{PR}$$ where

P is power output in watts, and

R is load resistance in ohms.

Using a 4-watt output into 50 ohms,

$$E_{PEAK} = 1.4\sqrt{4 \times 50}$$
$$= 20 \text{ volts}$$

If we consider that this value can almost double with 100 percent modulation and can be multiplied several times again by severe load mismatches, the importance of minimizing the voltage to the counter becomes obvious.

c. Without using a signal tap, or any external hook-ups, the optional Antenna, SA-27, can pick up the transmitted frequency within approximately 6 feet of the transmitting antenna at 27 MHz. **NOTE:** For automotive dash or service bench mounting of your frequency counter, the optional mounting bracket, MB-27, is recommended. This versatile bracket allows you to mount the counter either on top of or below your automobile dash or service bench shelf. Complete installation instructions are included with each bracket.

2. Amplitude-Modulated Signals.

Erroneous frequency readings may be obtained if carrier frequency measurements are performed with a high percentage of amplitude modulation present. This is caused by the fact that the carrier level periodically decreases to a near zero amplitude at 100% modulation. If this modulated signal is applied to the frequency counter through a signal tap as outlined earlier, the possibility of the carrier level dropping to a value lower than the counter sensitivity must be considered. When this occurs, the counter does not count during the entire interval and an erratic and inaccurate reading results. For more reliable results, the amplitude modulation should be removed when carrier frequency measurements are performed.

The frequency of the modulating signal, if in the audio range, can be measured if a suitable detector with low-pass filter is used between the signal test point and counter.

3. Square Wave or Pulse Train Measurement.

In some cases, miscounts can occur when measuring the frequency of square waves or a pulse train, particularly if an unterminated input cable is used. That error is caused by "ringing" or overshooting in the unterminated transmission cable. A damping resistor in series with the cable signal line can eliminate this effect. For example, a 91KΩ series resistor will give you 10X attenuation, giving a total equivalent load impedance of 100KΩ.

In practically all cases where the output of a pulse or square wave generator is being measured, satisfactory results are obtained if a short cable is used with a terminating resistor at the counter input which matches the generator impedance.

4. VHF/UHF Frequency Measurement.

Your frequency counter is compatible with all commercially available prescalers to extend the frequency range up to the UHF range (with 100:1 prescaling).

THEORY OF OPERATION

Your frequency counter consists of an input section, time base circuit, counter section, display, and power supply circuitry.

1. INPUT

The input circuit consists of a protected differential amplifier (IC1) and PNP output stage (Q1) with Schmitt-trigger and count control circuitry (IC8).

2. TIME BASE

A precision 4 MHz oscillator serves as the timing control for the complex internal timing generated by the custom L.S.I. Integrated Circuit, IC3.

3. COUNTER SECTION

The two divide-by-ten counters (IC2,7) and the custom L.S.I. Integrated Circuit (IC3) serve as the complete counting circuit.

4. DISPLAY

Multiplexed BCD signals from the counter chain internal to IC3 are decoded through IC101, which drives the 7-segment displays. IC4 provides the current sinking needed for the digit strobing and IC5 provides necessary drives to the decimal points and kHz/MHz indicators.

5. POWER SUPPLY

Wide voltage operation (6 to 9V) requires two regulating transistors (Q3,5) to keep the voltage within a limited range for certain IC's.

NOTES

RECALIBRATION AND MAINTENANCE

Your counter was carefully checked and calibrated at the factory prior to shipment. There are three adjustments in all the circuitry, so recalibration is not difficult, if it is ever required.

Calibration of this instrument should not be attempted unless you are experienced and qualified in the use of precision laboratory equipment. Should any difficulty occur during repair or calibration, refer to the warranty service instructions at the rear of this manual for information on technical assistance.

Location of adjustment points are shown in Fig. 11. Access to the printed circuit board is the same as for battery replacement.

To calibrate the oscillator, a 10 MHz standard with accuracy of at least ±1 part in 10^8 is required to set the oscillator ±1 Hz of 10 MHz (a 1 MHz standard can be used to set the oscillator ±10 Hz of 10 MHz).

PROCEDURE:

1. Adjust R9 so that the emitter of Q5 measures 4.75 volts with 6 volts applied at the collector of Q5.

2. Adjust R24 so that Pin 1 of IC8 measures 2 volts with 6 volts applied at the collector of Q5 and no input signal.

3. Place unit at room ambient temperature, unless a more specific temperature is required for the temperature at which your frequency counter is most often used. See "SPECIFICATIONS" for frequency stability.

4. Connect the standard frequency source to the input jack.

5. Operate unit near the center of the voltage operating range (7.5 volts) or use optional AC adapter BC-27. See "OPTIONAL ACCESSORIES."

6. Set function switch to 1 SEC position.

   The instrument will overrange and the most significant digits will be lost.

7. With a non-metallic alignment tool, adjust C12 for display reading equal to the standard frequency ±1 count.

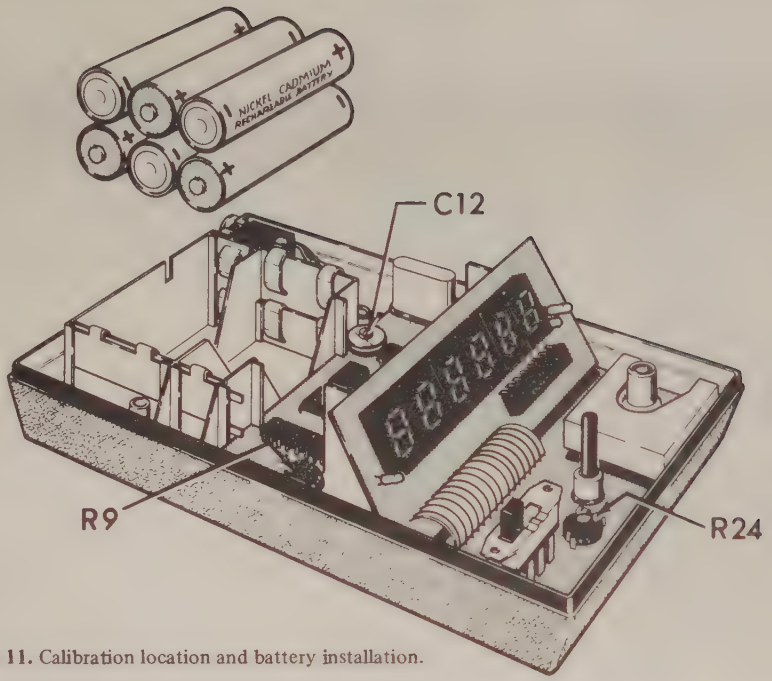


Fig. 11. Calibration location and battery installation.

BATTERY REPLACEMENT AND INSTALLATION

Remove the 4 screws at the bottom of the case and remove the top cover from your frequency counter. Observe proper polarity when installing new batteries. See Fig. 11. If alkaline or carbon-zinc type batteries are being used, they should be removed immediately when expended to prevent instrument damage from battery leakage.

PENLIGHT SIZE "AA" BATTERIES

Type	Neda	Burgess	Eveready	Mallory	RCA	Ray-O-Vac
Carbon-Zinc	15	930	1015	M15R	VS 334	15
Alkaline	15A	AL9	E91	Mn1500	VS1334	815

RECHARGEABLE TYPES

Type	G.E.	Gould	Eveready
Ni-Cad	GCE450SB	500SC	CH500

CB CHANNEL FREQUENCY ALLOCATIONS

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
1	26.965	21	27.215
2	26.975	22	27.225
3	26.985	23	27.255
4	27.005	24	27.235
5	27.015	25	27.245
6	27.025	26	27.265
7	27.035	27	27.275
8	27.055	28	27.285
9	27.065	29	27.295
10	27.075	30	27.305
11	27.085	31	27.315
12	27.105	32	27.325
13	27.115	33	27.335
14	27.125	34	23.345
15	27.135	35	27.355
16	27.155	36	27.365
17	27.165	37	27.375
18	27.175	38	27.385
19	27.185	39	27.395
20	27.205	40	27.405

WARRANTY SERVICE INSTRUCTIONS

1. Refer to the MAINTENANCE section of your B & K-Precision instruction manual for adjustments that may be applicable.

2. Defective parts removed from units which are within the One Year Limited Warranty period should be sent PREPAID to the Service Department listed below. Be sure to state the model and serial number of the unit from which the parts were removed and date the unit was purchased. These parts will be exchanged at no charge, under the terms of the Warranty.

3. If the above-mentioned procedures do not correct the problem you are experiencing with your unit, pack it securely (preferably in the original carton or double-packed). Enclose a letter describing the problem and include your name and address. Deliver to, or ship PREPAID (UPS preferred) to the nearest B & K-Precision authorized service agency (see list enclosed with unit).

If your list of authorized B & K-Precision service agencies has been misplaced, contact your local distributor for the name of your nearest service agency, or write to:

Service Department

B & K-Precision Product Group
DYNASCAN CORPORATION
2815 West Irving Park Road
Chicago, Illinois 60618

LIMITED ONE-YEAR WARRANTY

DYNASCAN CORPORATION warrants to the original purchaser that its B & K-PRECISION product, and the component parts thereof, will be free from defects in workmanship and materials for a period of one year from the date of purchase.

DYNASCAN will, without charge, repair or replace, at its option, defective product or component parts upon delivery to an authorized B & K-PRECISION service contractor or the factory service department, accompanied by proof of the date of purchase in the form of a sales receipt.

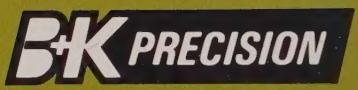
To obtain warranty coverage, this product must be registered by completing and mailing the enclosed warranty registration card to DYNASCAN, B & K-PRECISION, P.O. Box 35080, Chicago, Illinois 60635 within five (5 days) from the date of purchase.

Exclusions: This warranty does not apply in the event of misuse or abuse of the product or as a result of unauthorized alterations or repairs. It is void if the serial number is altered, defaced or removed.

DYNASCAN shall not be liable for any consequential damages, including without limitation damages resulting from loss of use. Some states do not allow limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty gives you specific rights and you may also have other rights which vary from state to state.

For your convenience we suggest you contact your B & K-PRECISION distributor, who may be authorized to make repairs or can refer you to the nearest service contractor. If warranty service cannot be obtained locally, please send the unit to B & K-PRECISION Service, 2815 West Irving Park Road, Chicago, Illinois 60618, properly packaged to avoid damage in shipment.



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